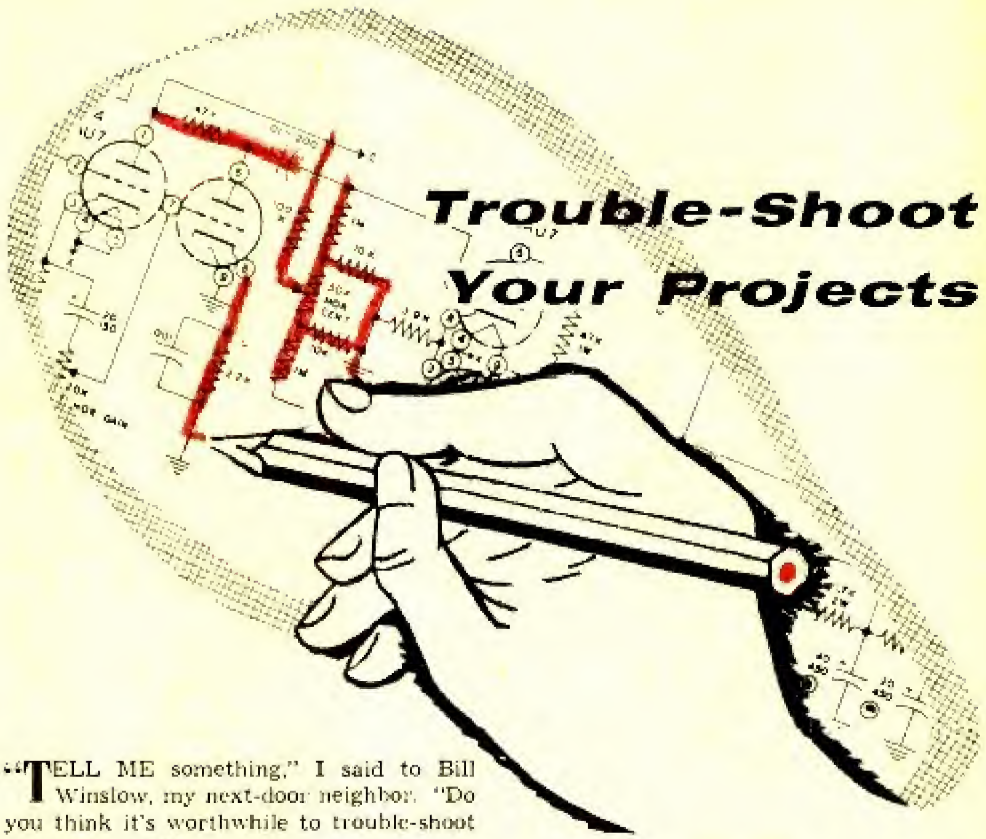
Trouble-Shoot Your Projects



By DAVID R. ANDERSON

How to find those hidden bugs with a red pencil

"TELL ME something," I said to Bill Winslow, my next-door neighbor. "Do you think it's worthwhile to trouble-shoot your own kit?"

"I sure do," he replied.

"Well," I said doubtfully, "it's okay for you to say that. You're a professional trouble-shooter. How about an average kit builder like me?"

"Let's put it this way. If you're willing to invest a little time and effort, you can save the cost of having the unit factory-serviced. And it should take less time than sending the kit back to the factory."

"That sounds logical." A gleam came into my eye. "The reason I asked is that I bought an oscilloscope kit the other day. Then after I got it together I couldn't get it to work. I've been knocking myself out over it, but no go."

"I suppose you were wondering if I could give you a hand?" Bill ventured.

"Right," I admitted.

"Well, I don't see why not," he said. "Where is the thing?"

"Right this way." We headed for my cellar. Downstairs we came face to face with the monster that had given me such a hard time.

"So this is it." Bill looked over the schematic. "It shouldn't be too hard. Have you got a colored pencil?"

I searched through the drawers and finally came up with one. "What, may I ask, do you want with that?"

"I'm going to trouble-shoot your kit."

"With a colored pencil?"

"That's right," he said.

"THERE are three major reasons," Bill continued, "why kits fail to work after they're put together. The first, and most common, is a wiring error."

"But I've already checked the wiring," I alibied.

"And you're positive everything is cor-

rect so far as the wiring is concerned."

"As sure as I can be," I insisted, a bit dubiously.

"Well, I'm going to make absolutely sure with this red pencil and schematic." He laid the schematic on the bench. "First we'll pick a likely starting point, say the rectifier cathode. Then we'll trace out each connecting wire and compare it with the schematic. If it's correct, we'll cover the line on the schematic with a colored line."

"I suppose if you come across a component in the line being traced you check it for proper value and rating?" The soundness of the idea had started to penetrate.

"Right," Bill answered. "If the value is correct, we place a small check mark next to it on the schematic."

I watched while he worked. He progressed steadily and soon the schematic was covered with colored lines and small checks. All but one line was finally covered. Bill looked up. "Suppose you take over from here."

A glance told me where the mistake was. The line not covered with red showed a connection to pin five of the vertical amplifier. I had made the connection to pin four.

Red-faced, I said: "That just shows, experience is what counts."

"That's not necessarily so," Bill said. "You could have done the same thing I did. As a matter of fact, this is the first time I ever saw that particular model scope." Bill looked closely at the joint I soldered when I had corrected the wiring error. He went on: "The beauty of this system is that it will work well on any kit the first time you attempt to make repairs on it."

"Okay," I said. "Let's plug her in and give it a try."

"WHOA. Not so fast." Bill held my arm. "Remember, I said there were three major causes of kit failure."

"That's right, you did," I answered. "But we found the trouble with this one, no?"

"We found *one* trouble. From the looks of some of those solder joints you may have more." He jiggled a wire going to a terminal to which several other wires were fastened. My jaw dropped as I saw it loosen. All that had been holding it was rosin.

"And there," he said, "you have the second major cause of trouble—a cold solder joint." He picked up my soldering iron and solder.

"I should know better," I moaned. "A good solder joint is a shiny one."

"Well, don't feel too bad," he said with a grin. "Even the pros make a mistake once in a while. The thing to remember is: a joint that is dull and full of rosin is probably cold-soldered and will give trouble."

He took the iron and applied it to the joint. When the joint was hot enough, he applied the solder to the spot where the iron met the joint, as should be done. When the joint cooled, it was shiny and free of rosin.

"That, my boy, is the proper way to solder."

I NODDED my head in agreement. I was about to plug in the scope when the thought struck me. "You said there were three major causes of kit failure, right?"

"Right," Bill answered.

"We've only checked two. What's the next thing?" I asked.

While the author deals with kit trouble-shooting, the method he uses is completely adaptable to any type of electronic project published in POPULAR ELECTRONICS. A professional trouble-shooter for a kit manufacturer, Mr. Anderson points out that the home builder should have no difficulty in following the suggestions he outlines for any type of circuit.

The Editors

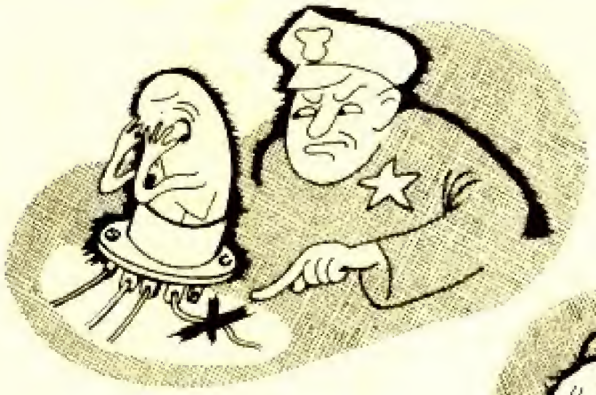
"I'm glad you asked. Shows you're coming out of the fog you've been in."

I ignored his attempt to be funny.

"So far we've found out that the wiring and soldering are correct. If the kit doesn't work now, the trouble will be a defective component."

"Then I might as well plug the unit in and see what happens," I said.

"Before you plug it in it's a good idea to check for shorts. You might save a part from burning up." Bill turned on my vacuum-tube voltmeter. He switched it to the ohmmeter section.



"I suppose you're going to check the resistance against the manufacturer's specs?" I asked.

"That's right," he answered.

"You'll remember to allow a margin of 20% in the readings?" That scored one for me.

Bill didn't bother to answer. Soon he was finished.

"Well, everything checks okay. Let's plug 'er in."

I plugged in the power cord and the trace swept across the face of the CRT. After a few adjustments it was clean and sharp.

"That's a pretty good trace," I said.

"It sure is," Bill agreed. "But I've got a question for you. If the scope hadn't operated when you plugged it in, then what?"

"Voltage checks, of course," I said.

"Allowing the usual 20% tolerance, right?" That scored one for Bill.

"Right," I said, and grinned. "You sure have a foolproof system worked out. I spent two days trying to find the trouble with that thing and you come along and have it working in less than an hour."

"Well, if there's one thing I learned the hard way, it's to be systematic in trouble-shooting a kit. I used to probe around and try to guess at what the trouble was, but I never got anywhere. The only way to tackle this type of problem is to start at the beginning. That means check the wiring and soldering first," he said seriously.

"LET'S SEE if I have this straight," I ventured. "First of all you should check the wiring with the colored pencil and the schematic to be certain it's correct. Then you check the soldering to make sure all joints are properly soldered. When this is done, you give it a resistance check to be sure there are no shorts. After that, if the unit still doesn't work, you give it a voltage check."

"Absolutely right," said Bill. "Of course, it's a good idea to have the tubes tested before you start the voltage check. It may save you some trouble."

I gazed at the sharply focused trace on the scope and said: "You know, Bill, you're right. It is worthwhile to trouble-shoot your own kit. It not only gives you confidence in your workmanship, but helps you to understand how the unit works." —30—